mal high pressure over Mauritius would increase the monsoon current and the Indian rainfall; but this did not prove to be the case. The relations between rainfall in India and atmospheric pressure over India, Siberia, the Indian Ocean, and South America are such that in years of excessive monsoon rainfall in India the atmospheric pressure over South America is too high, and conversely, small rainfall in India goes with low pressure in South America. Moreover in many years the low pressure occurs earlier in South America than the small rainfall in India. A table of snowfall for fifteen years shows that in the case of heavy and late snowfalls, when the area in the Indian highlands covered with snow in May is larger than usual, it argues for small rainfall in June.

Thirteen years of records show that heavy rainfall in the subequatorial region, over Zanzibar and the Seychelles, brings deficient rainfall in India over both branches of the *monsoon*; so that in general the snowfall in upper India is not connected primarily with the subsequent defect in rainfall, but is only an indication of a disturbance in the general circulation of the atmosphere. Moreover excessive rainfall at Zanzibar in April and May coincides with deficient height of the flood wave in the Nile River; so that we may say that a deficient snowfall in upper India coincides with a deficient flood in the Nile. On the other hand heavy snowfall in India and heavy rainfall in the equatorial region is paralleled by the connection between abnormal rainfall at Zanzibar and the Seychelles in November, with heavy snowfall in upper India in the subsequent cold season.

With regard to atmospheric pressure and rainfall high pressure in Mauritius means small rainfall in India, and low pressure in Mauritius is followed by heavy rainfall in India, in a large majority of cases, namely, 80 per cent. Comparing pressures in Argentina with rainfall in India, Walker and Hann are led to the remarkable result that positive departures of pressure in the spring at Cordoba are followed by positive departures of the next following summer rainfall in India. The worst drought in India, with a rainfall departure of —24 per cent, or 254 millimeters, was preceded by a departure of —1.4 millimeters of barometric pressure at Cordoba; whereas the best monsoon rainfall, 1892, with a departure of +124 millimeters, was preceded by +1.8 millimeters of pressure departure at Cordoba. According to the last memorandum by G. T. Walker, large departures of pressure in July at Mauritius have a close connection with the simultaneous opposite departures of rainfall in August and September over the whole of India.

In conclusion Hann says that the method by which Walker has carried out his investigation seems to be the most appropriate, namely, the comparison of the departures of the meteorological elements. We must know both the direction and the quantity of the departures. We must compare them geographically as well as chronologically. The best example of such work consists in Hann's study of the anomalies of the weather in Iceland as compared with those on the continent of Europe.

LONG-RANGE SEASONAL FORECASTS FOR SOUTH AFRICA.

Mr. D. E. Hutchins, conservator of forests for South Africa, read a paper before the South African Philosophical Society, at Cape Town, November 29, 1905, entitled "The cycle year 1905 and the coming season". An abstract, furnished by Mr. Hutchins, occupies pages 98–105 of the Agricultural Journal of the Cape of Good Hope for January, 1906, Volume 28, No. 1. The author has made an elaborate study of the rainfall data published regularly in the Agricultural Journal by Mr. Charles M. Stewart, Secretary to the Meteorological Commission of Cape Colony; and while his first thought has been to work out chronological cycles in South African rain, he has also lookt for geographical relations, namely, the relations between the rains of South Africa and those of the states to the north of it, as well as of more distant countries. The first publication of Mr. Hutchins that we find mentioned is one of 1888, entitled "Cycles of Drought and Good Seasons in South Africa". For the present paper of November, 1905, he prepared diagrams of the rainfall records at Cape Town, Grahamstown, and Durban, which accord remarkably with the three cycles that he has worked out for Cape Colony weather. These cycles he designates as follows (see Table 1):

(1) The "solar cycle" of 11.11 years, whose maximum occurred in 1905, and which happened that year to agree with the maximum of sun spots, but does not always do so; three of these solar cycles, or the 35-year sun-spot cycle, he calls the "Brueckner cycle".

(2) A cycle of alternating periods of nine and ten years, or an average of nine and a half years; this he terms the "storm cycle"; its maximum will occur in 1907; it has its greatest influence on the winter rainfall of the western portion of South Africa, while in the eastern portion it is liable to bring only wind. This also corresponds to the mean period between successive droughts in Australia.

(3) A cycle with alternating periods of twelve and thirteen years, or an average period of twelve and a half years; this he terms the "Meldrum cycle", in compliment to that eminent meteorologist; this cycle brings a good deal of general rain, but usually especially affects the summer rainfall of the eastern districts of South Africa.

TABLE 1.— *Dates of cycles.*

Solar cycle, 11.11 years.	Brueckner cycle, 35 yrs.	Storm cycle, 9.5 years.	Meldrum cycle, 12.5 yrs.	Wolfer's sun-spot numbers.	
Maxima.	*Maxima.*	*Maxima.*	*Maxima.*	*Maxima.*	*Minima.*
		1813.0			
1816.62				1816.4	
			1818.0		
		1822.5			1823.3
1827.73					
			1830.5	1829.9	
		1832.0			1833.9
	1835.5				
1838.84				1837.2	
		1841.5	1843.0		1843.5
1849.95				1848.1	
		1851.0			
			1855.5		1856.0
1861.06		1860.5		1860.1	
			1868.0		1867.2
	1870.5	1869.5		1870.6	
1872.17					
		1879.0	1880.5		1878.9
1883.28				1883.9	
		1888.5			1889.6
			1893.0		
1894.39				1894.1	
		1898.0			
					1902.0
1905.50	1905.5		1905.5	1905.5	
		1907.5			

These three cape weather cycles were recognized by Mr. Hutchins in 1888. By means of them the rainfall of that year was predicted, and he states that they have agreed with the rainfall of subsequent years, with but few failures. As we have not the rainfall data at hand we can only quote Mr. Hutchins's statement that, during the period 1841–1905 at Cape Town, the Meldrum cycle has failed once and been one year late three times. During the period 1865–1905 the storm cycle has failed three times out of four at eastern stations, and has sometimes been late; but at Grahamstown itself only one failure and one lateness have occurred. At Durban, however, the storm cycle has failed twice, and the rains came late five times during the period 1866–1905. After a detailed consideration of the rainfall for each year from 1865 to 1905, given on pages 104, 105, he states the following conclusions : (1) The three main weather cycles are of general application thruout South Africa, and the storm cycle and Meldrum cycle are of general application east and west beyond their areas of greatest influence. (2) As we go northward the heavier rainfall occurs a season earlier. (3) There are obscure indications of a tendency to rain at the sun-spot minimum, but the normal minima (he uses 1844–1855–1867–1878–1889–1900) have so frequently coincided with the other cycles that the exact influence of the sun-spot minimum is difficult to trace, and further observations are necessary. (4) Up to the present time the direct influence of Brueckner's 35-year cycle is inappreciable in South African weather.

In conclusion, Hutchins offers a forecast as to the rainfall. In 1888 he published a forecast for the year 1905, namely, that the sun-spot cycle and the Meldrum cycle would coincide, and therefore "most probably general good rains". For 1906 his prediction then was: "Probably good rains, with drought at a few stations". He claims that the forecast for 1905 was well verified, and now, namely, in November, 1905, after studying recent conditions, he offers the following forecast for the next two years:

For South Africa generally, except the southern and southwest coast of Cape Colony [all which is included in his summer rainfall area], the year 1906, coming between two rainfall periods, may have short and local droughts, or the rains may run on to the heavy rainfall period which is ahead of us in 1907, and probably in 1908; the outlook now is for several years of good rainfall ahead.

For the south and southwest coasts of Cape Colony strong "southeasters", really southerly and southwesterly winds, may be expected during the summer; the cyclical indication for next winter's rains (1907) is that they will be moderate.

Long-period forecasts can not have anything like the precision of the short, day-or-two forecasts; * * * they are at best but a calculation of probabilities and an indication of what may be expected to affect the coming season as a whole. * * * For the drier inland districts the rains are too irregular for the cyclical forecast to have any practical value. After 1908 there are six years of drought to be looked forward to, with an irregular mitigation of the drought, most probably about 1911 or 1912.

The more we consider the statements contained in Mr. Hutchins's abstract, the more certain does it seem that he has shown that sun-spot cycles have nothing to do with the variations of rainfall in South Africa. On the other hand, he has shown that there are certain correlations between the rainfall in the east and the west, such that when the one goes up the other goes down. He finds so many exceptions to the chronological regularity of heavy and light rains that the probability is that there is no such regularity at all, so that cycles of 12.5, 11.11, 35, and 9.5 years, all of which he investigates, have no real existence. But, on the other hand, the fact that the area of heavy rain, with its outlying region of lighter rains, moves about, east and west, north and south, becomes clearly evident. When this geographical motion is large one is tempted to hunt for a cycle to correspond, but nothing of the kind appears from his data. On the contrary, by studying the monsoon data of the east coast of Africa it is plain that, as he himself says, "the rains are too irregular for the cyclical forecast to have any value".—*C. A.*

WILHELM VON BEZOLD.

This eminent meteorologist was born at Munich on the 21st of June, 1837, and died at Charlottenburg, near Berlin, on the 17th of February, 1907. After twenty years of service in the University of Munich, where he organized the Bavarian Meteorological Service, he was called to be Director of the Royal Meteorological Institute at Berlin, in 1885, where he was made professor in the university, a member of the Royal Academy of Sciences, and one of the curators of the Imperial Physico-Technical Institute, and where also he attained the rank of Royal Privy Councilor.

Von Bezold's contributions to the study of the thermodynamics of the atmosphere have been of the highest importance. Fortunately all of these memoirs were revised and edited by himself in a volume of collected memoirs published in 1906. The first three out of the five have also been translated and published by the Smithsonian Institution, so that they are as well known outside of Germany as inside. His first meteorological memoir was that of 1864 on observations and theory of the twilight, a memoir that became widely known as soon as the red twilights of the Krakatoa eruption revived our interest in the subject. His last meteorological memoir on climatological averages for complete circles in latitude brings us to the summit of our present knowledge of the general relation between the temperature of the earth and the heat that it receives from the sun.

Not only meteorology but equally terrestrial magnetism attracted his attention and became illumined by his thought, and his most eminent pupil in this line of research, Dr. L. A. Bauer, is now carrying out, with the help of the Carnegie Institution of Washington, those broad researches that von Bezold initiated. Von Bezold's principal memoirs on this subject have been published since 1895, but it had been treated of in university lectures for many years before. Many of his devoted students and admirers have lately combined to publish a memorial volume in which they will doubtless work out many of the ideas that he so freely suggested as topics for further research.—*C. A.*

A WINTER WATERSPOUT.

By DAVID CUTHBERTSON, Local Forecaster. Dated Buffalo, N. Y., February 25, 1907.

An unusual phenomenon was observed by the office force at the Buffalo station and a few visitors to the office on the afternoon of Monday, February 11, 1907, when a well-defined funnel-shaped cloud formed over this end of Lake Erie. It was first observed near the extreme western limit of the open water, about a quarter of a mile west of the outer lighthouse. (See fig 1.) This lighthouse is located midway between the American and Canadian shores where the lake begins to narrow into the Niagara River, and on account of the strong current ice seldom forms within one-sixth of a mile of the lighthouse on either side. This open water usually extends from a quarter to a half mile southwestward up the lake, converging to a V-shape at the southwestern end. At about 2:40 p. m. a well-defined tornado-like column formed near the extreme limit of the open water. The column in its early stages seemed to waver with the force of the wind for a few minutes, having all the appearance of the great waves of steam or fog, with a rolling motion against the wind. Suddenly, about 2:45 p. m., the cloud straightened up, the top having an altitude of about 100 feet, and started southwestward across the ice fields toward the south shore. The cloud had all the characteristics of a well-defined tornado funnel, or waterspout, appearing to be from 30 to 50 feet in diameter at the base and spread out to about 100 feet at the top. It retained its funnel shape as it advanced over the ice, licking up the snow as it went, until about a quarter of a mile off the south shore, when it began to waver and slowly vanish, breaking away at the bottom first. The wind at the time was blowing at the rate of 36 miles an hour from the northwest, driving a current of air with a temperature of 2° directly across the open water, whose temperature was about 34°, and into the center of the "V". The violent rotary motion is believed to have been due to this cold current driving against a body of relatively warm air over the open water, which was also forced up into the apex of the "V", and having an expansive upward tendency, mixt with the cold current in such a way as to produce the funnel cloud. From information at hand, a well-marked track over the ice fields was left clear of snow.

Two similar clouds were observed about two and a half miles up the lake at about the same time. These, however, appeared to have only the wave-like motion, and did not form an upright column.

During the afternoon a narrow band of strato-cumulus clouds, about 45° wide, extended from northeast to southwest over this